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I, MARIO PERUSSICH, ASSISTANT DIRECTOR PATENT SERVICES, hereby certify that the annexed is a true copy of the Provisional specification in connection with Application No. PO 8025 for a patent by SILVERBROOK RESEARCH PTY LTD filed on 15 July 1997.

I further certify that the annexed specification is not, as yet, open to public inspection.

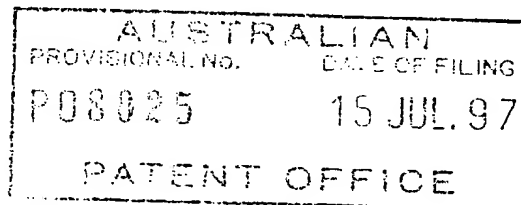WITNESS my hand this Twenty-second day of June 1998

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AUSTRALIA

Patents Act 1990

PROVISIONAL SPECIFICATION

AUSTRALIAN
PROVISIONAL NO.   DATE OF FILING
P08025   15 JUL. 97
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Application Title: Image Processing Method and Apparatus (ART08)

The invention is described in the following statement:

GH REF: 23975Y

IMAGE PROCESSING METHOD AND APPARATUS (ART08)

Field of the Invention

The present invention relates to an image processing method and apparatus and, in particular, discloses a process
5   for Utilising Autofocus Information in a Digital Image Camera.

The present invention further relates to the utilisation of autofocus information in a digital camera system.

10   Background of the Invention

Recently, digital cameras have become increasingly popular. These cameras normally operate by means of imaging a desired image utilising a charge coupled device (CCD) array and storing the imaged scene on an electronic
15   storage medium for later down loading onto a computer system for subsequent manipulation and printing out. Normally, when utilising a computer system to print out an image, sophisticated software may be available to manipulate the image in accordance with requirements.

20   Unfortunately such systems require significant post processing of a captured image and normally present the image in an orientation to which is was taken, relying on the post processing process to perform any necessary or required modifications of the captured image.

25   Summary of the Invention

It is an object of the present invention to provide a means for enhanced processing of images captured by a digital camera utilising, autofocus information.

In accordance with a first aspect of the present
30   invention there is provided a method of processing a digital image comprising:

capturing the image utilising an adjustable focusing technique;

utilising the focusing settings as an indicator of the
35   position of structures within the image; and

processing the image, utilising the said focus settings

to produce effects specific to said focus settings.

Brief Description of the Drawings

Notwithstanding any other forms which may fall within the scope of the present invention, preferred forms of the invention will now be described, by way of example only, with reference to the accompanying drawings which:

Fig. 1 illustrates the method of the preferred embodiment.

Description of Preferred Embodiments

The preferred embodiment is preferable implemented through suitable programming of a hand held camera device such as that described in Australian Provisional Patent Application entitled "Image Processing Method and Apparatus (ART01)" filed concurrently herewith by the present applicant the content of which is hereby specifically incorporated by cross reference.

The aforementioned patent specification discloses a camera system, hereinafter known as an "Artcam" type camera, wherein sensed images can be directly printed out by an Artcam portable camera unit. Further, the aforementioned specification discloses means and methods for performing various manipulations on images captured by the camera sensing device leading to the production of various effects in any output image. The manipulations are disclosed to be highly flexible in nature and can be implemented through the insertion into the Artcam of cards having encoded thereon various instructions for the manipulation of images, the cards hereinafter being known as Artcards. The Artcam further has significant onboard processing power by an Artcam Central Processor unit (ACP) which is interconnected to a memory device for the storage of important data and images.

Turning now to Fig. 2, there is illustrated the a method of utilisation of the Artcam device as described in the aforementioned Australian Provisional Patent Application with the numbers referring to those reference

numeral as set out in the aforementioned specification.

In the preferred embodiment, autofocus is achieved by processing of CCD data stream to ensure maximum contrast. Techniques for determining a focus position based on a CCD data stream are known. For example, reference is made to "The Encyclopedia of Photography" editors Leslie Stroebel and Richard Zakia, published 1993 by Butterworth-Heinemann and "Applied Photographic Optics" by London & Boston, Focal Press, 1988. These techniques primarily rely on measurements of contrast between adjacent pixels over portions of an input image. The image is processed by the ACP in order to determine a correct autofocus setting.

This autofocus information is then utilised by the ACP 31 in certain modes, for example, when attempting to locate faces within the image, as a guide to the likely size of any face within the image, thereby simplifying the face location process.

Turning now to Fig. 1, there is illustrated 1 an example of the method utilised to determine likely image characteristics for examination by a face detection algorithm.

Various images eg. 2, 3 and 4 are imaged by the camera device. As a byproduct of the operation of the auto-focusing the details of the focusing settings are stored by the ACP 31. Additionally, a current position of the zoom motor 38 is also utilised 6. Both of these settings are determined by the ACP 31. Subsequently, the ACP 31 applies any analysis techniques 8 to the detected values before producing an output 9 having a magnitude corresponding to the likely depth location of objects of interest within the image.

Next, the depth value is utilised in a face detection algorithm 10 running on the ACP 31 in addition to the inputted sensed image 11 so as to locate objects within the image. A close range value 9 indicates a high probability of a portrait image, a medium range indicates a high

probability of a group photograph and a further range indicates a higher probability of a landscape image. This probability information can be utilised as an aid for the face detection algorithm and also can be utilised for

5 selecting between various parameters when producing "painting" effects within the image.

It would be appreciated by a person skilled in the art that numerous variations and/or modifications may be made to the present invention as shown in the specific embodiment

10 without departing from the spirit or scope of the invention as broadly described. The present embodiment is, therefore, to be considered in all respects to be illustrative and not restrictive.

The present provisional is one of a series of

15 Australian Provisional Patent Applications which relate to a new form of technology for the production of images. These Australian Provisional Patent Applications encompass a broad range of fields and as such, the present provisional is best viewed in the overall context of the development of this new

20 form of technology. Appendix A attached hereto sets out the details of each of the series of Australian Provisional Patent Applications and, to the extent necessary, the associated Australian Provisional Patent Applications are hereby incorporated by cross-reference.

We Claim:

    1.   A method of processing a digital image comprising:

    capturing the image utilising an adjustable focusing technique;

5   utilising the focusing settings as an indicator of the position of structures within the image; and

    processing the image, utilising the said focus settings to produce effects specific to said focus settings.

    2.   A method as claimed in claim 1 further comprising

10   the step of:

    capturing said image utilising a zooming technique; and

    utilising zooming settings in a heuristic manner so as to process portions of said image.

15   3.   A method as claimed in claim 1 wherein said processing step comprises utilising said auto focus information to assist in the location of objects within the image.

    4.   A method as claimed in claim 1 wherein said focus

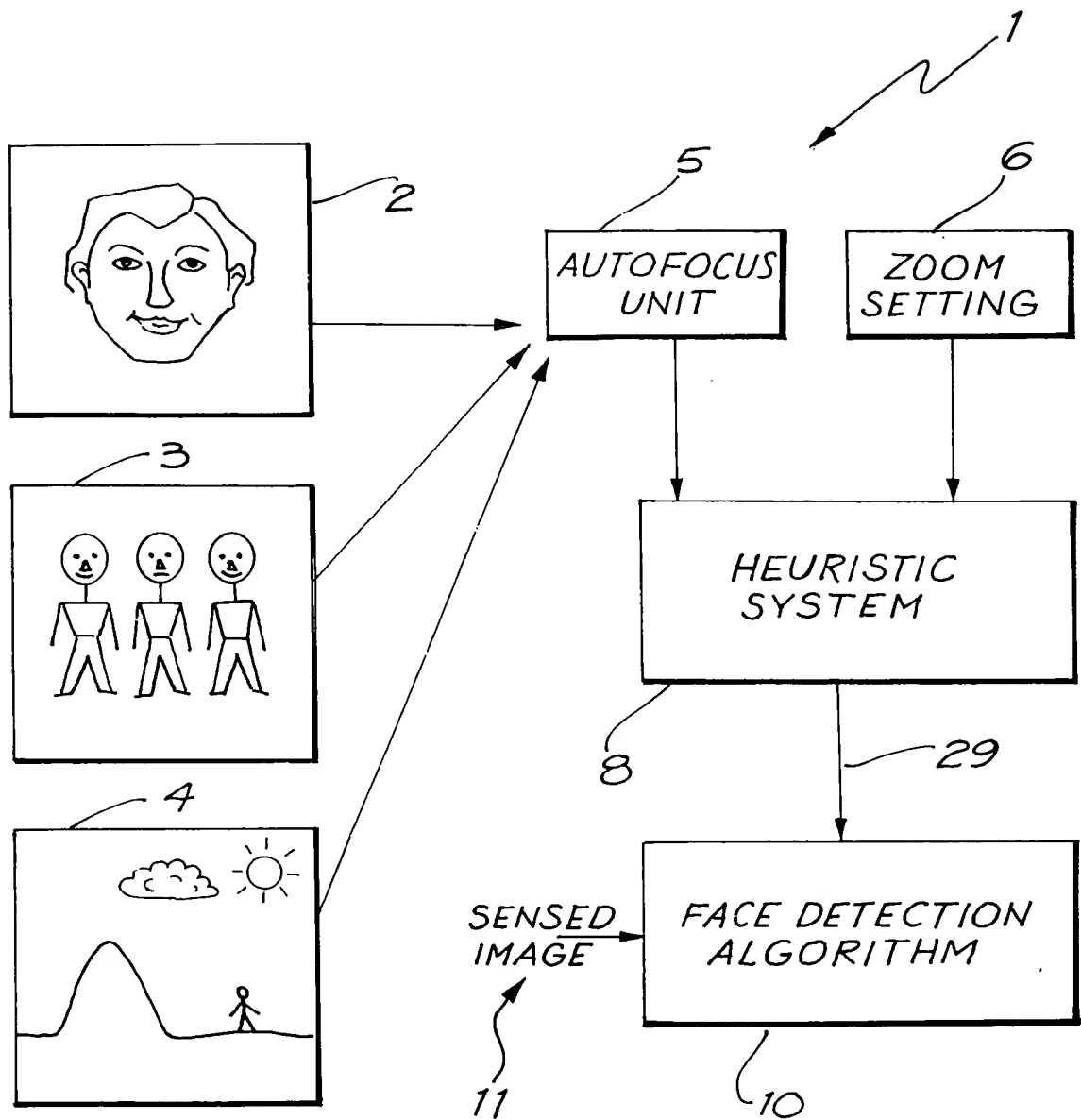20   setting is derived from a CCD captured digital image a CCD captured digital image.

FIG. 1

Abstract

A method of processing a digital image comprising:

capturing the image utilising an adjustable focusing technique;

5 utilising the focusing settings as an indicator of the position of structures within the image; and

processing the image, utilising the said focus settings to produce effects specific to said focus settings.

Appendix A – Related Australian Provisional Patent Applications

The present provisional is one of a series of interrelated Australian Provisional Patent Applications filed concurrently by the present Applicant and which together relate to a new image processing system which presents a large number of significant advances in a number of technological fields. These fields include, but are not limited to those set out in the following table:

- Camera technologies
- Display technologies
- Image processing
- Ink Jet printing technology
- Semiconductor fabrication technology
- Micro Electro Mechanical Systems (MEMS)
- VLSI and ULSI fabrication including Thin Field Techology
- Magnetics
- Fluid dynamics
- Precision engineering
- Plastics molding
- Materials science
- Digital systems architecture
- Fluid Dynamics
- Precision Engineering
- Non-impact printing technologies
- Mechanical and stress analysis
- Ink Chemistry
- Electronics
- Electrostatics

Naturally with such a large number of significant advances, it is necessary to read this Application with its associated Australian Provisional Patent Applications to gain a thorough understanding of the operation of these technologies. The following tables set out a full list of the associated Australian Provisional Patent Applications filed concurrently herewith by the present applicant which should be referred to in obtaining a full understanding of the operation of the present invention:

Ink Jet Printing

A large number of new forms of ink jet printers have been developed to facilitate alternative ink jet technologies for the image processing system. Australian Provisional Patent Applications relating to these ink jets include:

Image Creation Method and Apparatus (IJ01)
Image Creation Method and Apparatus (IJ02)
Image Creation Method and Apparatus (IJ03)
Image Creation Method and Apparatus (IJ04)
Image Creation Method and Apparatus (IJ05)
Image Creation Method and Apparatus (IJ06)
Image Creation Method and Apparatus (IJ07)
Image Creation Method and Apparatus (IJ08)
Image Creation Method and Apparatus (IJ09)
Image Creation Method and Apparatus (IJ10)
Image Creation Method and Apparatus (IJ11)
Image Creation Method and Apparatus (IJ12)
Image Creation Method and Apparatus (IJ13)
Image Creation Method and Apparatus (IJ14)

Image Creation Method and Apparatus (IJ15)
Image Creation Method and Apparatus (IJ16)
Image Creation Method and Apparatus (IJ17)
Image Creation Method and Apparatus (IJ18)
Image Creation Method and Apparatus (IJ19)
Image Creation Method and Apparatus (IJ20)
Image Creation Method and Apparatus (IJ21)
Image Creation Method and Apparatus (IJ22)
Image Creation Method and Apparatus (IJ23)
Image Creation Method and Apparatus (IJ24)
Image Creation Method and Apparatus (IJ25)
Image Creation Method and Apparatus (IJ26)
Image Creation Method and Apparatus (IJ27)
Image Creation Method and Apparatus (IJ28)
Image Creation Method and Apparatus (IJ29)
Image Creation Method and Apparatus (IJ30)
Supply Method and Apparatus (F1)
Supply Method and Apparatus (F2)

Ink Jet Manufacturing

Significant developments have occurred in the field of ink jet print head construction. These advances are
included in the following Australian Provisional Patent Applications.

A Method of Manufacture of an Image Creation Apparatus (IJM01)
A Method of Manufacture of an Image Creation Apparatus (IJM02)
A Method of Manufacture of an Image Creation Apparatus (IJM03)
A Method of Manufacture of an Image Creation Apparatus (IJM04)
A Method of Manufacture of an Image Creation Apparatus (IJM05)
A Method of Manufacture of an Image Creation Apparatus (IJM06)
A Method of Manufacture of an Image Creation Apparatus (IJM07)
A Method of Manufacture of an Image Creation Apparatus (IJM08)
A Method of Manufacture of an Image Creation Apparatus (IJM09)
A Method of Manufacture of an Image Creation Apparatus (IJM10)
A Method of Manufacture of an Image Creation Apparatus (IJM11)
A Method of Manufacture of an Image Creation Apparatus (IJM12)
A Method of Manufacture of an Image Creation Apparatus (IJM13)
A Method of Manufacture of an Image Creation Apparatus (IJM14)
A Method of Manufacture of an Image Creation Apparatus (IJM15)
A Method of Manufacture of an Image Creation Apparatus (IJM16)
A Method of Manufacture of an Image Creation Apparatus (IJM17)
A Method of Manufacture of an Image Creation Apparatus (IJM18)
A Method of Manufacture of an Image Creation Apparatus (IJM19)
A Method of Manufacture of an Image Creation Apparatus (IJM20)
A Method of Manufacture of an Image Creation Apparatus (IJM21)
A Method of Manufacture of an Image Creation Apparatus (IJM22)
A Method of Manufacture of an Image Creation Apparatus (IJM23)
A Method of Manufacture of an Image Creation Apparatus (IJM24)
A Method of Manufacture of an Image Creation Apparatus (IJM25)
A Method of Manufacture of an Image Creation Apparatus (IJM26)
A Method of Manufacture of an Image Creation Apparatus (IJM27)
A Method of Manufacture of an Image Creation Apparatus (IJM28)
A Method of Manufacture of an Image Creation Apparatus (IJM29)
A Method of Manufacture of an Image Creation Apparatus (IJM30)

MEMS Technology
The following application relate to Micro Electro-Mechanical Systems technologies:

A device (MEMS01)
A device (MEMS02)
A device (MEMS03)
A device (MEMS04)
A device (MEMS05)
A device (MEMS06)
A device (MEMS07)
A device (MEMS08)
A device (MEMS09)
A device (MEMS10)

Artcam Technologies
The following Australian Provisional Patent Applications relate to the a new field of image processing technology known as Artcam.

Image Processing Method and Apparatus (ART01)
Image Processing Method and Apparatus (ART02)
Image Processing Method and Apparatus (ART03)
Image Processing Method and Apparatus (ART05)
Image Processing Method and Apparatus (ART06)
Media Device (ART07)
Image Processing Method and Apparatus (ART08)
Image Processing Method and Apparatus (ART09)
Image Processing Method and Apparatus (ART10)
Image Processing Method and Apparatus (ART11)
Image Processing Method and Apparatus (ART12)
Media Device (ART13)
Image Processing Method and Apparatus (ART12)
Media Device (ART15)
Media Device (ART16)
Media Device (ART17)
Media Device (ART18)
Data Processing Method and Apparatus (ART19)
Data Processing Method and Apparatus (ART20)
Media Processing Method and Apparatus (ART21)
Image Processing Method and Apparatus (ART22)
Image Processing Method and Apparatus (ART23)
Image Processing Method and Apparatus (ART24)
Image Processing Method and Apparatus (ART25)
Image Processing Method and Apparatus (ART26)
Image Processing Method and Apparatus (ART27)
Data Processing Method and Apparatus (ART29)
Data Processing Method and Apparatus (ART32)
Image Processing Method and Apparatus (ART33)
Sensor Creation Method and Apparatus (ART36)
Data Processing Method and Apparatus (ART37)
Data Processing Method and Apparatus (ART38)
Data Processing Method and Apparatus (ART39)
Data Processing Method and Apparatus (ART40)
Data Processing Method and Apparatus (ART43)
Data Processing Method and Apparatus (ART44)
Data Processing Method and Apparatus (ART45)
Data Processing Method and Apparatus (ART46)

Data Processing Method and Apparatus (ART50)
Data Processing Method and Apparatus (ART51)
Data Processing Method and Apparatus (ART52)
Image Processing Method and Apparatus (ART53)
Image Processing Method and Apparatus (ART54)
Image Processing Method and Apparatus (ART56)